Foundations of Statistical Modeling II

Multinomial Processing Tree (MPT) Modeling: Basic Methods and Recent Advances, Block 4

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4) Applications II

- 4.1) Decision Inertia
- 4.2) Paradigm
- 4.3) Model construction
- 4.4) Application to empirical data

An example from decision research

- Decision inertia
- Examples:
  - Brand loyalty
  - Telephone contracts from the 1970s
  - Financial investments
  - ...
- Definition (Jung, Erdfelder, Bröder & Dorner, 2018)
  - Decision inertia is “the decision-makers’ tendency to repeat the previous decision regardless of the consequences, even if it is clearly inferior to other options (Alós-Ferrer et al., 2016; Sautua, 2017).

Paradigm (Alós-Ferrer et al., 2016)

Tabelle 2. Verteilung der Kugeln in den Urnen in den jeweiligen Zuständen in diesem Experiment. Der unbekannte Zustand der Welt (A bzw. B) legt die Verteilung in den Urnen (Links, Rechts) fest.

Zustand der Welt (Wahrscheinlichkeit)	Linke Urne	Rechte Urne
A (1/2)	●●●●○○	●●○○○○
B (1/2)	●●○○○○	●●●●○○

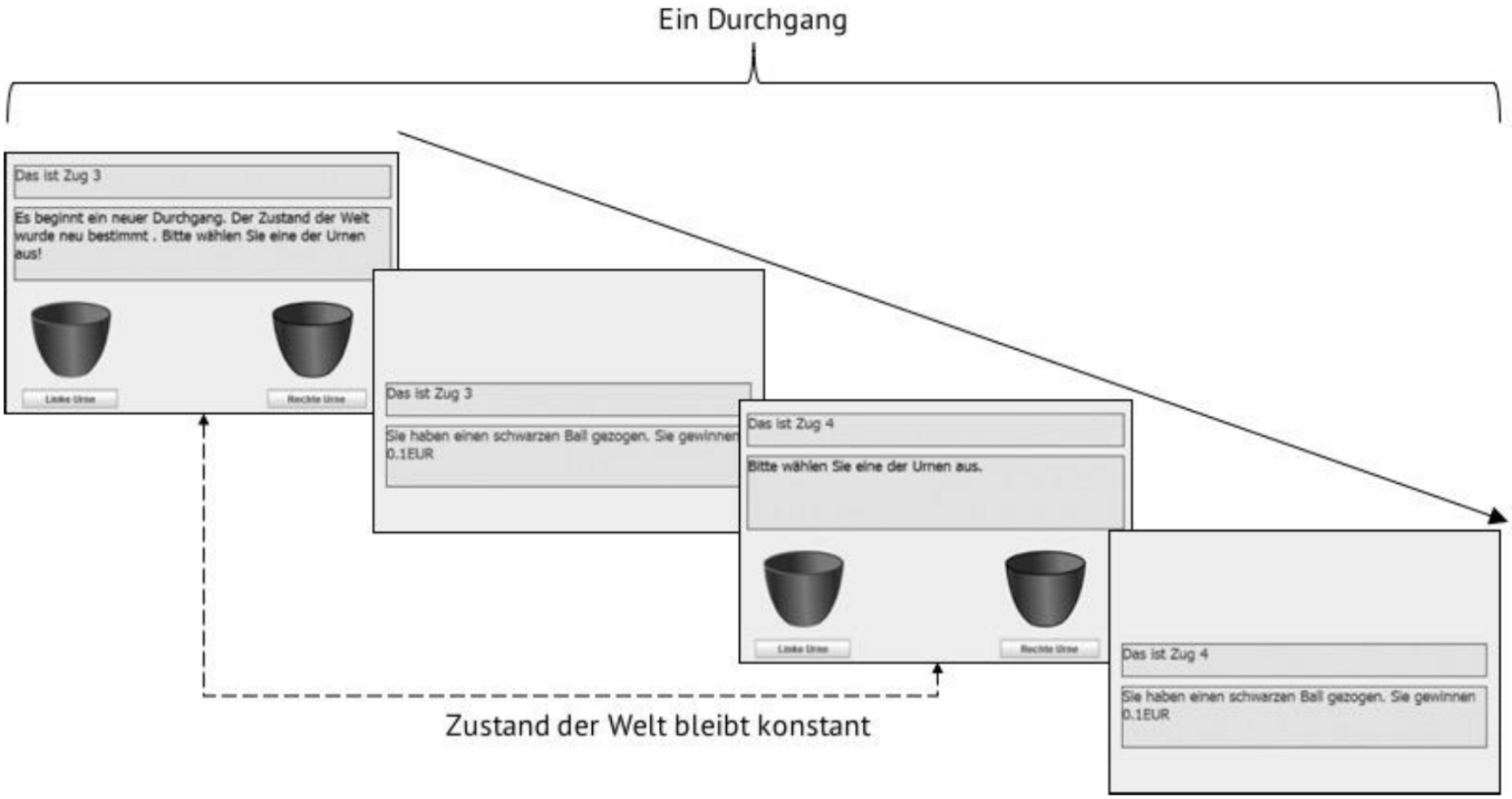


Abbildung 2. Exemplarische Darstellung eines Durchgangs des Urnenspiels. Vor einem Durchgang wird der Zustand der Welt entsprechend der Wahrscheinlichkeiten neu bestimmt, innerhalb eines Durchgangs bleibt der Zustand der Welt konstant. Nach Wahl einer Urne wurde den Probanden im nächsten Bild die Farbe der gezogenen Kugel und der erspielte Betrag angezeigt.

Standard analysis

- Definition of an ad-hoc measure (proxy) of decision inertia
- E.g., error rate :
- K := f(stick to urn given failure in Trial 1)
- Logistic Regression (or Probit Regression)
  - Criterion: K
  - Predictors: Motivational or cognitive variables

Let us develop an MPT model!

Recall work flow:

- Select a paradigm (e.g., a task)
- Define the conditions of the paradigm
- Define category system for each condition
- List relevant processes/parameters
- Construct theoretically reasonable processing branches („trees“) for each condition.
- As simple as possible!

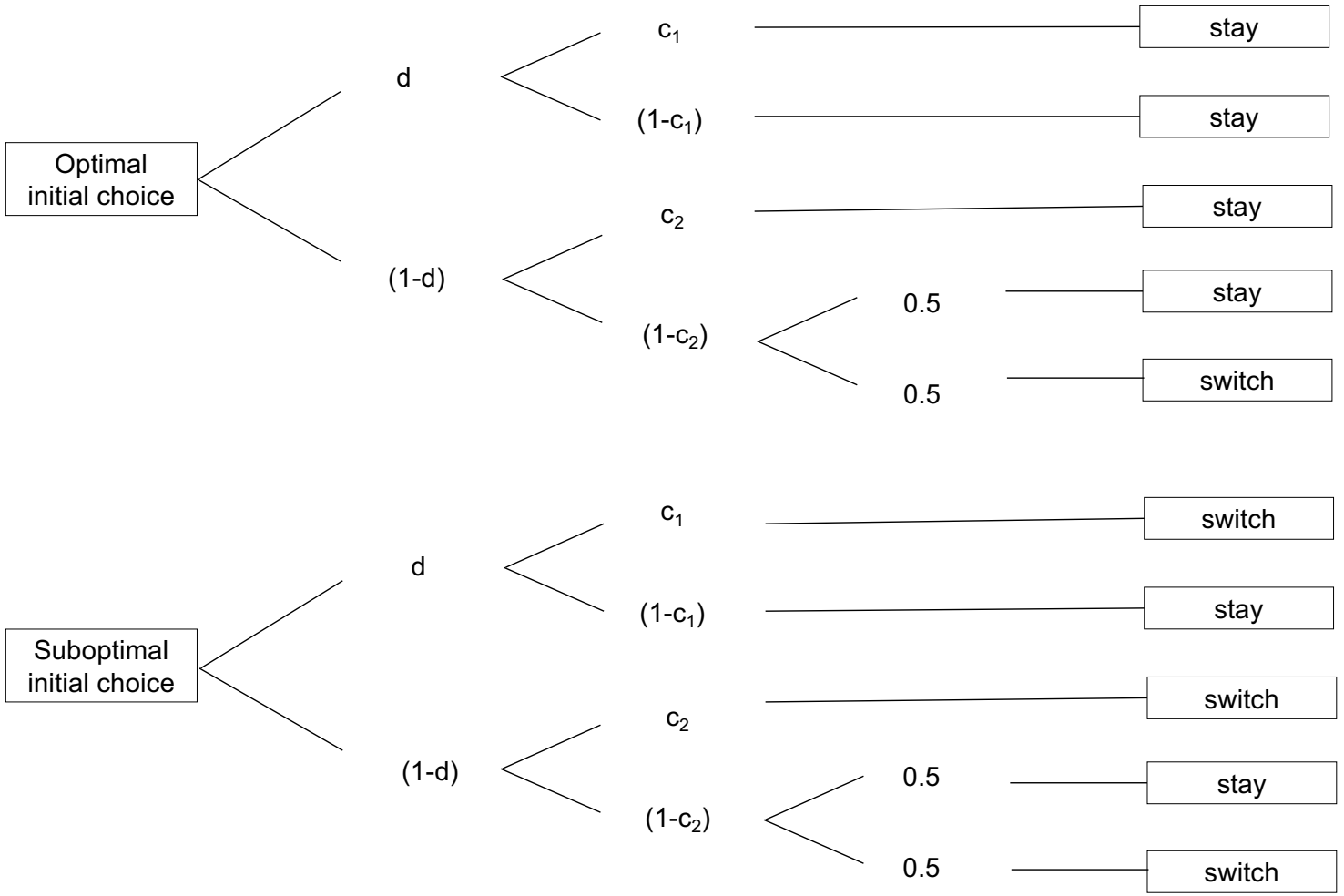
Decision Inertia MPT Model

- Model assumptions:
- Choices in 2nd trial are affected by two processes:
- 1) Decision Inertia (active vs. inactive)
  - p(decision inertia) = d
- 2) Bayesian Updating (active vs. inactive)
  - p(Bayesian updating) = c_1 bzw. c_2

Decision Inertia MPT Model

- Additional assumptions:
  - If none of the two processes is active in Trial 2, people choose randomly in Trial 2;
  - If exactly one of the processes is active in Trial 2, this process determines the choice;
  - If both processes are active, Bayesian updating dominates over decision inertia

Decision Inertia MPT Model



Model validation

- 2 x 2-factorial design
- Factor A:
  - First choice fixed vs. free
- Factor B
  - Success rate optimal urn: 80% vs. 60%
- Predictions:
  - A affects *d* but not *c*
  - B affects *c* but not *d*

Results for pilot data

- 3-parameter base model:
  - $G^2(2) = 1.87, p = .392$
  - ΔBIC = -15.15
- 2-parameter independence model (c_1=c_2):
  - $G^2(4) = 9.41, p = .052$
  - $\Delta G^2(2) = 7.54, p = .023$
  - ΔBIC = -24.62

ML parameter estimates (and std. errors) of independence model

- Decision Inertia
  - 1. choice fixed: est d = .141 (.042)
  - 1. choice free: est d = .453 (.041)
- Bayesian Updating
  - Success rate 60%: est c = .591 (.016)
  - Success rate 80%: est c = .715 (.014)